

CLAIMS

WE CLAIM:

1. A nickel based alloy for use as a coating comprising:
a composition represented by the formula MCrAlYX wherein M comprises at least one member of the group consisting of Ni, Co, and Fe;
X comprises at least one member of the group consisting of Pt, Hf, Si, Zr, Ta, Re, and Ru; and wherein the weight percentage of X to the total composition is within the range of about 0.1% to about 28.0%.
2. The nickel based alloy according to claim 1 wherein the weight percentage of X to the total composition is within the range of about 0.5% to about 15.0%.
3. The nickel based alloy according to claim 1 wherein the weight percentage of X to the total composition is within the range of about 1.0% to about 7.0%.
4. The composition according to claim 1 wherein M comprises at least one member of the group consisting of Ni and Co.

5. The composition according to claim 1 wherein M comprises Ni/Co alloy.
6. The composition according to claim 1 wherein M comprises Ni.
7. The composition according to claim 1 wherein X comprises two or more elements from the group consisting of: Pt, Hf, Si, Zr, Ta, Re, and Ru..
8. The composition according to claim 1 wherein X comprises three or more elements from the group consisting of: Pt, Hf, Si, Zr, Ta, Re, and Ru.
9. The composition according to claim 1 wherein X comprises four or more elements from the group consisting of: Pt, Hf, Si, Zr, Ta, Re, and Ru..

10. A nickel based powder composition for use in depositing a coating on a superalloy substrate comprising the following ingredients and weight percentages:

<u>Element</u>	<u>Range Weight %</u>
Co	about 15 - about 22
Cr	about 15- about 25
Al	about 8- about 15
Y	about 0.1- about 1.0
Pt	about 20- about 35
Hf	about 1.0- about 5.0
Si	about 1.0- about 5.0
Zr	about 1.0 about -3.0
Ta	about 1.0- about 5.0
Re	about 1.0- about 5.0
Ru	about 1.0- about 5.0
Ni	Remainder.

11. A nickel based powder composition for use in depositing a coating on a superalloy substrate comprising the following ingredients and weight percentages:

<u>Element</u>	<u>Range Weight %</u>
Co	about 15 - about 22
Cr	about 15- about 25
Al	about 8- about 15
Y	about 0.1- about 1.0
Pt	0 - about 35
Hf	0 - about 5.0
Si	0 - about 5.0
Zr	0 - about -3.0
Ta	0 - about 5.0
Re	0 - about 5.0
Ru	0- about 5.0
Ni	Remainder.

12. The nickel based powder composition according to claim 11
having the following ingredients and weight percentages:

<u>Element</u>	<u>Weight %</u>
Co	about 20
Cr	about 25
Al	about 13
Y	about 0.3
Hf	about 2.0
Si	about 0.65
Re	about 3.0
Ni	Remainder.

13. The nickel based powder composition according to claim 11
having the following ingredients and weight percentages:

<u>Element</u>	<u>Weight %</u>
Co	about 20
Cr	about 22
Al	about 13
Y	about 0.3
Hf	about 2.0
Si	about 0.65
Re	about 3.0
Ru	about 1.5
Ni	Remainder.

14. The nickel based powder composition according to claim 11
having the following ingredients and weight percentages:

<u>Element</u>	<u>Weight %</u>
Co	about 20
Cr	about 25
Al	about 13
Y	about 0.4
Hf	about 2.0
Si	about 0.80
Ni	Remainder.

15. A nickel based powder composition for use in depositing a coating on a superalloy substrate consisting essentially of the following ingredients and weight percentages:

<u>Element</u>	<u>Range Weight %</u>
Co	about 15 - about 22
Cr	about 15- about 25
Al	about 8- about 15
Y	about 0.1- about 1.0
Pt	about 20- about 35
Hf	about 1.0- about 5.0
Si	about 1.0- about 5.0
Zr	about 1.0 about -3.0
Ta	about 1.0- about 5.0
Re	about 1.0- about 5.0
Ru	about 1.0- about 5.0
Ni	Remainder.

16. A nickel based powder composition for use in depositing a coating on a superalloy substrate comprising the following ingredients and weight percentages:

<u>Element</u>	<u>Range Weight %</u>
Co	about 15 - about 22
Cr	about 15- about 25
Al	about 8- about 15
Y	about 0.1- about 1.0
Hf	about 1.0- about 5.0
Si	about 1.0- about 5.0
Zr	about 1.0 about -3.0
Ta	about 1.0- about 5.0
Re	about 1.0- about 5.0
Ru	about 1.0- about 5.0
Ni	Remainder.

17. A nickel based powder composition for use in depositing a coating on a superalloy substrate consisting essentially of the following ingredients and weight percentages:

<u>Element</u>	<u>Range Weight %</u>
Co	about 15 - about 22
Cr	about 15- about 25
Al	about 8- about 15
Y	about 0.1- about 1.0
Hf	about 1.0- about 5.0
Si	about 1.0- about 5.0
Zr	about 1.0 about -3.0
Ta	about 1.0- about 5.0
Re	about 1.0- about 5.0
Ru	about 1.0- about 5.0
Ni	Remainder.

18. A method for applying a coating to a turbine blade surface comprising:

providing to the turbine blade surface a powder alloy represented by the formula $M\text{CrAlYX}$ wherein M wherein comprises at least one member of the group consisting of Ni, Co and Fe;

X comprises at least one member of the group consisting of Pt, Hf, Si, Zr, Ta, Re, and Ru; and wherein the weight percentage of X to the total composition is within the range of about 0.1% to about 28.0%; and

bonding the powder alloy to a turbine blade surface as a coating through laser powder fusion welding.

19. The method according to claim 18 wherein the weight percentage of X to the total composition is within the range of about 0.5% to about 15.0%.

20. The method according to claim 18 wherein the weight percentage of X to the total composition is within the range of about 1.0% to about 7.0%.

21. The method according to claim 18 wherein the step of bonding the powder further comprises laser welding with a direct diode, Nd:YAG, fiber, or CO_2 laser.

22. The method according to claim 18 further comprising the step of grinding the turbine blade tip.

23. The method according to claim 22 further comprising the step of grinding the turbine blade tip such that the turbine blade reaches a preferred dimension.

24. The method according to claim 18 wherein said bonding step results in a metallurgical bond between the substrate and the MCrAlYX coating.

25. The method according to claim 18 further comprising the step of depositing the powder alloy on the turbine blade in more than one layers through a series of more than one deposition steps.

26. The method according to claim 18 wherein said bonding step uses a laser with power between about 50 to about 2500 watts.

27. The method according to claim 18 wherein said bonding step uses a laser with power between about 50 to about 1500 watts.

28. The method according to claim 18 wherein the step of providing powder further comprises providing powder at a powder feed rate of about 1.5 to about 20 grams per minute.

29. The method according to claim 18 wherein the step of providing powder further comprises providing powder at a powder feed rate of about 1.5 to about 10 grams per minute.

30. A method for preparing a coated high pressure turbine blade for assembly in a gas turbine engine comprising the steps of:

- providing a suitable turbine blade having a tip to be coated;
- grit blasting the turbine blade;
- verifying a laser weld path on the turbine blade tip with a video camera;
- providing at the turbine blade tip a powder alloy represented by the formula $M\text{CrAlYX}$ wherein M wherein comprises at least one member of the group consisting of Fe, Ni, and Co; and wherein X comprises at least one member of the group consisting of Pt, Hf, Si, Zr, Ta, Re, and Ru; and wherein the weight percentage of X to the total composition is within the range of about 0.1% to about 28.0%;
- laser cladding the powder alloy to the turbine blade tip in a layer
- checking the depth of the layer deposited;
- repeating the steps of laser cladding and checking the depth until a desired coating thickness is achieved;
- grinding the turbine blade tip; and
- inspecting the turbine blade through FPI inspection or X-Ray inspection.

31. A method for depositing a modified MCrAlY coating onto a superalloy substrate in multiple layers comprising the steps of:
depositing a first layer of Pt-including modified MCrAlY onto the superalloy substrate; and
depositing a second layer of modified MCrAlY on top of the first layer.

32. The method according to claim 31 wherein said second layer includes Pt.

33. The method according to claim 31 wherein said second layer does not include Pt.

34. A coated turbine blade comprising:
an airfoil having a convex face and a concave face;
a base assembly attached to said airfoil;
a tip at the outer radial end of the airfoil; and
a coated region on the tip wherein the coated region comprises MCrAlYX.

35. The turbine blade according to claim 34 wherein said MCrAlYX coating has a thickness of up to approximately 0.050 inch.

36. The turbine blade according to claim 34 wherein said MCrAlYX coating has a thickness of up to approximately 0.020 inch.

37. The turbine blade according to claim 34 wherein said MCrAlYX coating comprises Platinum.

38. The turbine blade according to claim 34 wherein said coating has a thickness of up to approximately 0.020 inch after post-welding grinding.

39. The turbine blade according to claim 34 wherein said coating provides resistance to oxidation and corrosion.

40. The turbine blade according to claim 34 wherein said airfoil further comprises a superalloy.